Modulation of neural response in the prefrontal cortex and cerebellum by monetary reward and instrumental response on a GO/NO-GO task

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The compulsion to use drugs has been associated with the inability to change behavior when reward contingencies are changed. Previous research has implicated the prefrontal cortex and cerebellum in reward processing and inhibitory control in both humans and non-human primates. Although functioning in these two regions appears to be intercorrelated, posterior regions, including the cerebellum, may have unique roles in reward processing and inhibitory control. The scarcity of research on the role of the cerebellum vis-à-vis the prefrontal cortex in addiction calls for an in-depth exploration. We have previously reported that both cocaine users and controls activate the left lateral orbitofrontal cortex when given a monetary reward. However, whether these neural responses are modulated by instrumental responses and how the cerebellum is involved remains to be explored. Our aim was to determine if responses in these two regions of interest (ROI) are modulated by reward (no money vs. high money) or instrumental response (GO vs. NO-GO) as a function of addiction. Sixteen cocaine users and 13 controls underwent an fMRI BOLD study during a Go/No-Go task. We used repeated-measures ANCOVA to determine the effect of reward and instrumental response on BOLD signal in the selected ROIs. Results imply that the reward-related fMRI BOLD response is modulated by instrumental response, and this effect differs as a function of the ROI. We conclude that a dynamic neural networks analysis, which integrates measures of behavior, cognition and emotion, is most compatible for studying the neurobiology of addiction.